ClimateFarming Cycle Manual
ClimateFarming

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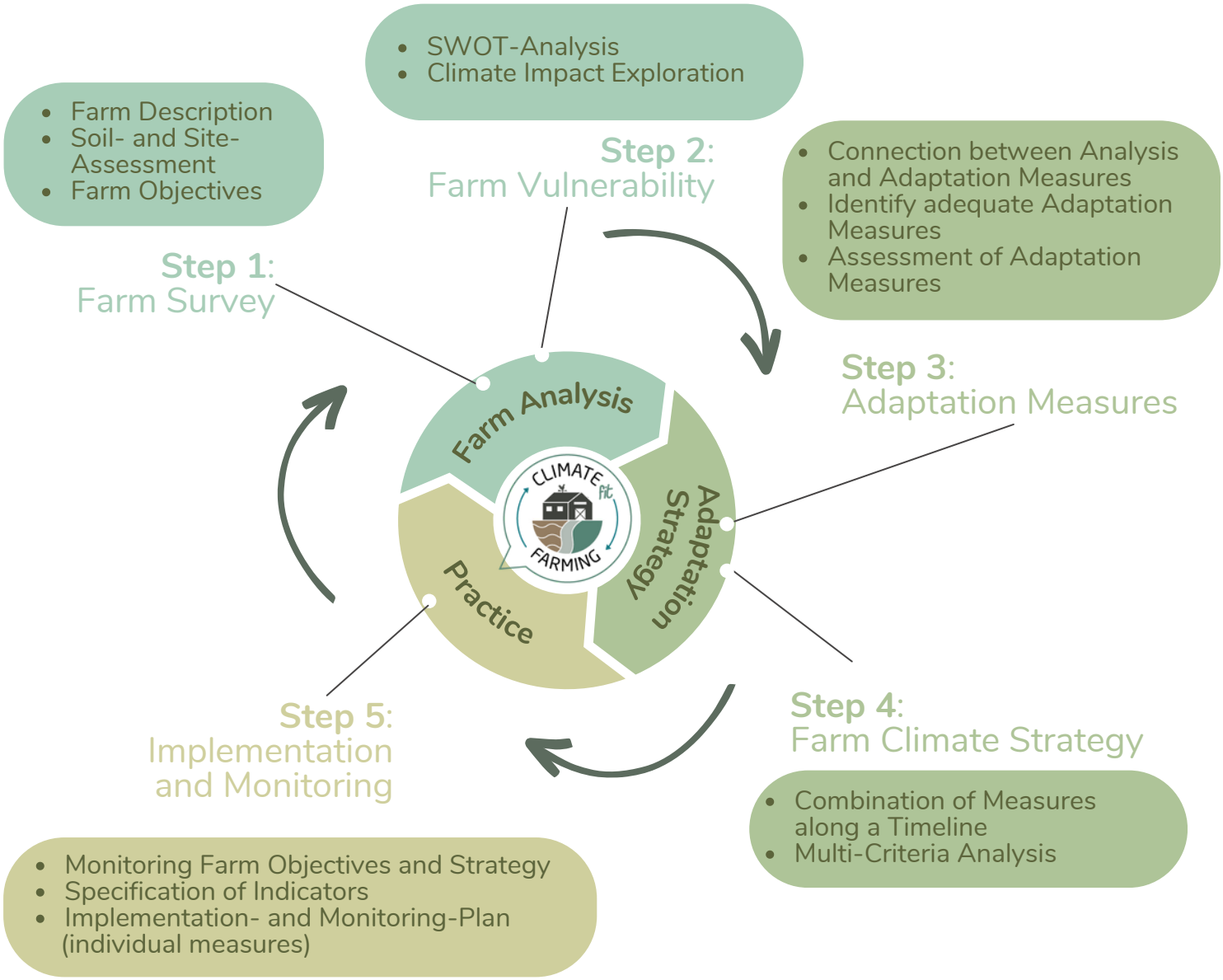
ClimateFarming-Cycle in Practice: Handout for Consultants



*Part of WP2 - A4: Consulting Material

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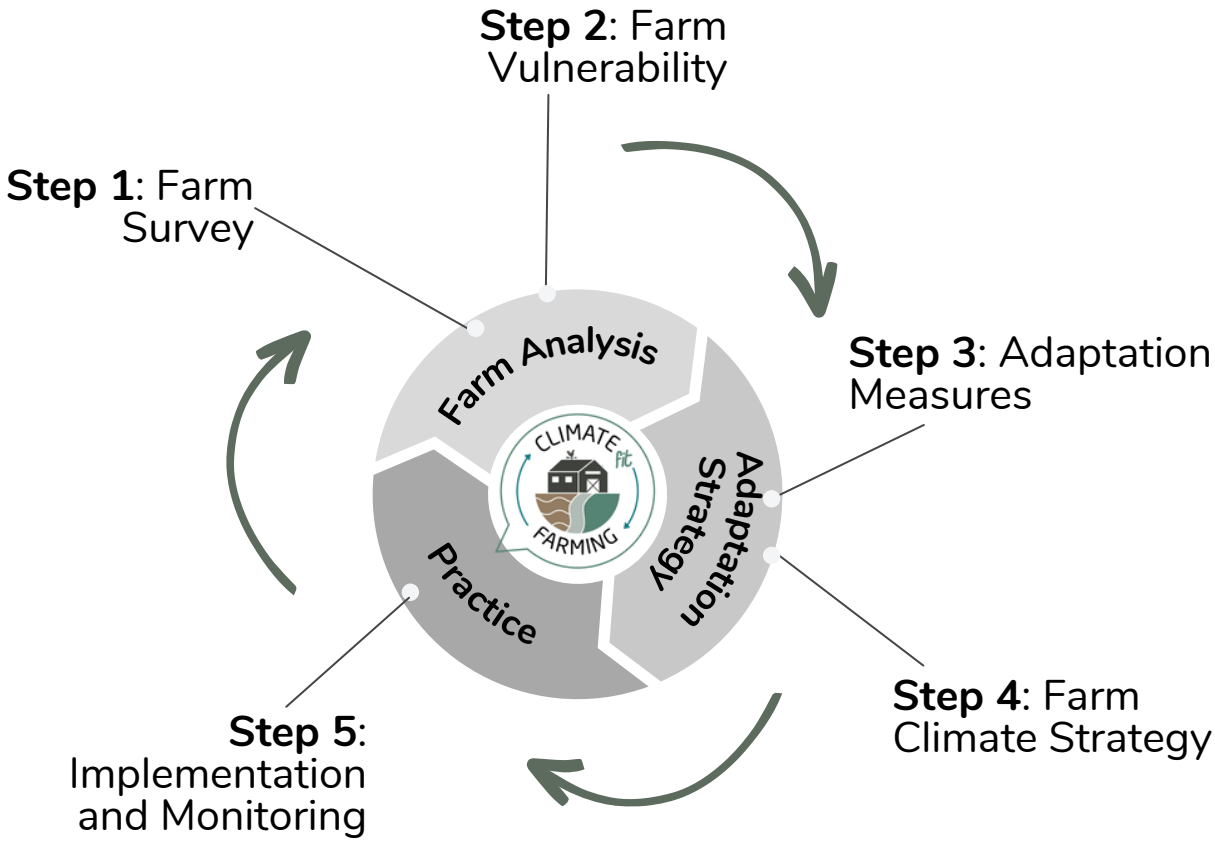
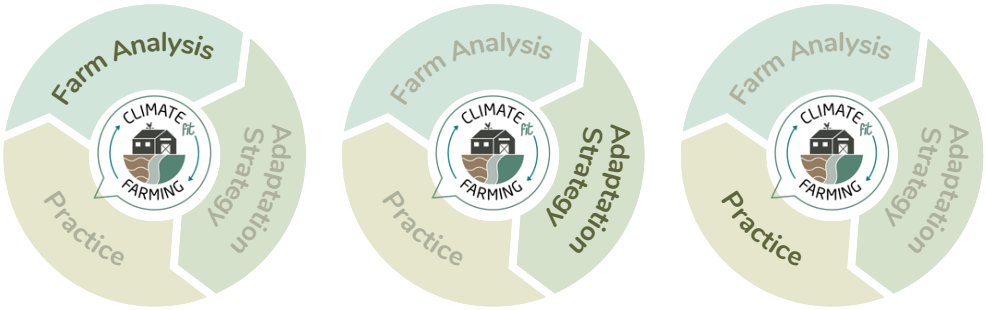




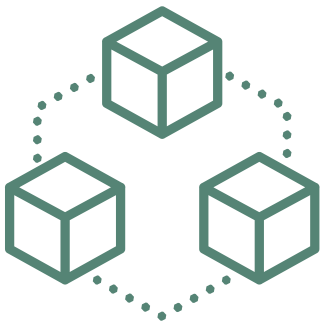
*Part of WP2 - A4: Consulting Material

CLIMATEFARMING-CYCLE HANDOUT: CONTENT

CLIMATEFARMING-CYCLE HANDOUT: INTRODUCTION

Module 2 equips you with a practice-oriented step-by-step guide for the farm-specific application of the ClimateFarming-Cycle.

The individual steps are based on each other, but can also be used in a modular manner. This means that you can choose which steps will be conducted, how they will be conducted and which methods you want to apply with the specific farm. In the course of the ClimateFarming-Cycle, the goal is to develop a farm-specific journal of the whole ClimateFarming process.



This file is the documentation of the ClimateFarming-Cycle application and consists primarily of the filled in templates of this handout, including the results of the individual steps. However, the journal should also be complemented by additional notes, pictures or documents, depending on the specific farm. The journal should also record how the individual steps were conducted. This documentation of the farm's adaptation process is supposed to serve as a foundation for the continuous re-evaluation of the farm climate strategy.

Each step of the ClimateFarming-Cycle Handout includes the following parts:

- a short summary,
- a list with preparations, materials and literature,
- a TO-DO list,
- templates to document results,
- info-sheets with further explanations.

Additionally, you will find these icons throughout the document:

Application notes: Some information to bear in mind when you conduct a task.

Example: What could an implementation of this task look like?

Bonus: These tasks or considerations can be especially helpful when you want to dig deeper encountering specific topics or challenges.

Involve expert: To conclude this task, you may want/need to consult an external expert service.

CLIMATEFARMING-CYCLE HANDOUT: INTRODUCTION

Application Notes

- Regenerative agriculture and adaptation are highly complex topics. Consequently, methods and concepts to deal with them are complex. **In order to use the materials of Module 2 adequately, we advise to first get acquainted with the content of the reading material and take part in a ClimateFarming-Training.**
- **It is important to respect the characteristics of the individual farm and to adjust the methods and scope of the ClimateFarming-Cycle accordingly.** Before application, it is crucial that farmer and ClimateFarming-Consultant discuss expectations and how the process can be designed to fit the farm context.
- The ClimateFarming-Cycle and its steps put high requirements on the ClimateFarming-consultant, as many steps are mainly based on the knowledge and assessment of the involved parties. In doubt, it is always recommended to employ external expert service in order to prevent misinformation or - in the worst case - maladaptive decisions with long-lasting consequences.
- The ClimateFarming-Cycle aims at reducing risk stemming from climate change uncertainty, albeit it can't be eliminated.

The ClimateFarming Framework was developed in Central Europe and thus many ressources and examples may be better suited for this context. The ClimateFarming concept and methods however can be used in a variety of places and contexts. Some additional research may be needed to complement the material.

The ClimateFarming-Consultant is an agricultural advisor who guides the farm members through the ClimateFarming Cycle. The consultant is acquainted with the materials and attended a ClimateFarming Training.

The Farm Members are all involved parties at the farm. This includes the farm manager, all working staff and possibly also familiy members or others that are involved in decision making or may be affected by new decisions.

STEP 1 - FARM SURVEY

Guiding questions: What is the status quo of our farm? What are we already doing concerning climate adaptation? What are our objectives as farmers?

Goals: Extensive farm description; understand the current state of the farm; formulate farm objectives

Preparation	Material and Literature
• Farm members get acquainted with Step 1 • Farm Survey is handed out • Farm members fill in the farm survey If possible: farm member did a first soil-/site-analysis	• Farm Survey + Documentation • Template: Farm Objectives • Info-Sheet: Objectives Literature: • Consultation Material: Introduction + Step 1

Summary:
Step 1 aims at describing the farm in its current state and is the foundation of the ClimateFarming-Cycle. This encompasses information concerning climate, soil, production branches and methods as well as other farm-related information. This information is condensed in the **Farm Survey.** The Farm Survey should be read carefully before conducting Step 1.

Following, farm objectives are formulated. This can encompass various goals, from economic performance to ecological and social aspirations or other farm-related aspects (e.g. working-hours). These objectives can complement or conflict with each other.

In order to find reasonable objectives, the approach is to formulate acceptable (minimum) outcomes for each farm objective. For example, for economic performance, the farm member should not ask "How much money can we maximally earn with the farm" but "**How much money do we need to earn with the farm in order to satisfy our needs?**" More information can be found in the **Info-Sheet: Objectives.**

STEP 1 - FARM SURVEY

To-Do List

- [ ] Optional: First acquaintances between ClimateFarming-Consultant and farm members
- [ ] Introduction to the ClimateFarming-Project, the ClimateFarming-Cycle and the goals of the ClimateFarming-Consulting; alignment with expectations of farm members
- [ ] Explanation of Step 1 and the Farm Survey and its parts, emphasizing its relevance for the ClimateFarming-Cycle
- [ ] The farmer fills in the Farm Survey; filled in Farm Survey is disscused with all farm members
- [ ] Missing parts are discussed and completed together with the ClimateFarming-Consultant
- [ ] If necessary, an additional date for the soil- and site-analysis is scheduled
- [ ] The objective formulation is explained
- [ ] Farm objectives are formulated
- [ ] Document the process and results; clarify open questions; continue with Step 2

Application Notes

An important part of Step 1 is to assess whether adaptation measures are already implemented or planned - intentionally or unintentionally. This provides a basis on which future measures can be based.

BONUS

Optional: If the CO2-footprint of the farm should be tracked, it is crucial to define how the baseline and improvements concerning climate protection will be assessed. One option is to conduct a professional CO2-footprint as provided by some extension services.

TEMPLATE: STEP 1 - FARM OBJECTIVES

Qualitative	Quantitative

TEMPLATE: STEP 1 - DOCUMENTATION

DATE: _____

WHO: _____

What did we do?
How did we do it?
Important discussion points etc.

Open questions, next steps and tasks

INFO-SHEET1: FARM OBJECTIVES

How to formulate Objectives (Consultation Material - Step 1)

- Focus of objective formulation should be on achieving **critical results for multiple objectives** instead of optimal (economic) outcomes
- A combination of guiding qualitative objectives and measurable, quantitative objectives is advisable

Example for objective formulation:

- **Profit-maximizing farmer**: Goal: “I want to earn as much money per year as possible with the farm"
  - This farmer seeks optimal (economic) results. In dairy farming, this farmer would search for the genetics which promise the highest yielding dairy cows. This maximizes profit in good years (no heat stress, good forage qualities), but is highly vulnerable towards unpredictable (climatic) changes, e.g. heat waves.
- **Resilient farmer**: Goal: “I need to generate an average income of 100.000€ per year so my farm can function properly and I'm able to build reserves"
  - This farmer would look for different traits in their dairy cows. Milk yield is important, but tolerance to heat stress or tolerance of low quality forage are likewise vital. The resilient farmer will not receive maximum yields (results) in good years, but is more resilient to variability, unforseen changes and will overall experience lower losses.

Application Notes

It is important that the relevance of objective formulation is well understood by all farm members. Likewise, the relevance of qualitative and quantitative goals should be well established. It must be clear that the farm objectives will have a large influence on which adaptation measures will be considered and finally constitute the farm climate strategy. Furthermore, farm objectives are the main indicator for us to assess whether a farm climate strategy is successful or not.

BONUS **Optional**: Other approaches to support objective formulation might be helpful at this point, e.g. SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound).

STEP 2 - FARM VULNERABILITY

Guiding questions: What are strengths and weaknesses of our farm? Which threats and opportunities exist? Which field-specific problems exist? What weather phenomena and extreme events have impacted our farm in the past? How can climate change affect our farming activities?

Goals: Comprehensive analysis of the current state of the farm using SWOT-Analysis; exploring past and possible future climate impacts; prioritize adaptation needs (SWOT aspects and/or climate impacts)

Preparation	Material and Literature
• Step 1 is conducted and all farm members agree wih the farm objectives • Soil- and Site-Analysis is conducted and all farm members understand the results	• Farm Survey • Results Soil and Site Analysis • Template: SWOT-Analysis • Template: Climate Impact Exploration • Consultation Material: Step 2

Summary: Step 2 serves as a farm-specific vulnerability analysis, exploring the potential climate impacts which will affect the farm - positive and negative. This step combines the analysis of current vulnerabilities with the exploration of experienced or potential climate impacts on the farm. The insights developed in Step 2 (together with Step 1) are the basis for compiling farm- and/or field-specific adaptation measures (Step 3).

Application Notes

The term vulnerability has evolved over time and can have, depending on the context, different definitions. In the ClimateFarming Project, “farm vulnerability” describes the predisposition of a farm system to be negatively impacted by changes in climate parameters (precipitation, hot days, etc.).

The assessment of farm vulnerability aims at the identification of climate change induced threats and chances for a specific farm system. Besides the creation of awareness, the goal of the process is to enable the farm members to prioritise certain climate impacts and find corresponding adaptation measures.

To-Do List

SWOT-Analysis

- [ ] The ClimateFarming-Consultant explains the step, its goals and methods
- [ ] Farm members agree on a method how the SWOT-Analysis should be conducted (e.g. open discussion, individual collection, etc.)
- [ ] The points of the SWOT-Analysis will be collected and discussed, if helpful their relative importance can be graded
- [ ] Document the process and results; clarify open questions; continue with the **Climate Impact Exploration**

Application Notes

It's important to acknowledge the temporal dimension of a vulnerability analysis, as vulnerability is developing dynamically with internal and external factors. Consequently, the farm vulnerability analysis is only a snapshot of the current situation and will change with time. As you continuously assess whether adaptation measures are successful, you regularly have to check whether vulnerabilities changed. This includes climatic changes, but also farm internal developments (e.g. staff changes).

INFO-SHEET 2: SWOT-ANALYSIS

SWOT-Analysis

- Step 1: Farm Survey provides the basis for the SWOT-Analysis of the farm
- The starting pointis the examination of the farm and its processes concerning strengths and weaknesses
- Strengths and weaknesses can comprise bio-physical (e.g. soil properties), financial (e.g. high indebtedness) or human resources (e.g. special skills)
- Opportunities and threats are trends and developments happening outside of the farm, e.g. markets, consumer preferences, technology, governance and input prices
- Rule of thumb: Strengths and weaknesses are all factors which can be directly influenced by the farmer, opportunities and threats are beyond the control of the farmer
- The same aspect can be a strength for one farm and a weakness for another farm, e.g. high degree of mechanisation

Example: Excerpt SWOT-Analysis “Sisters Farm“

S Strengths	• High degree of mechanization (low depen-dendence on external service)
O Opportunities	• Many farmers in the area with environmental aspirations: potential for cooperations
W Weaknesses	• Low soil organic carbon content • Erosion risk
T Threats	• Increasing energy and input prices • Lack of qualified employees

BONUS

In the case of a complex farming system with different production branches or an excessive high number of identified SWOT aspects, the TOWS-Analysis could be a reasonable addition. A TOWS-Analysis translates the results of the SWOT-Analysis into response strategies. The matrix is comparable to a SWOT matrix but includes four additional blocks which consider the interaction of the different SWOT factors (Strength/Opportunity, Weakness/Opportunity, Strength/Threat, Weakness/Threat). More Information can be found in the ClimateFarming Trainer Handbook.

TEMPLATE: STEP 2 - SWOT ANALYSIS

S
Strengths

W
Weaknesses

O
Opportunities

T
Threats

To-Do List

Climate Impact Exploration

- [ ] The ClimateFarming-Consultant explains the step, its goals and methods
- [ ] Past and recent weather phenomena and extreme events are collected and their impact on the farm analysed
- [ ] Potential future climate impacts are explored and collected
- [ ] The results of the climate impact exploration are set in relation with the SWOT-Analysis results in order to prioritize where adaptation is most necessary
- [ ] Collect the as most important assessed climate impacts (e.g. with the Template: Climate Impact Exploration)
- [ ] If necessary, **external experts** are consulted in order to analyse and interpret the potential climate impacts on production branches
- [ ] Document the process and results; clarify open questions; continue with **Prioritizing Adaptation Needs**

Application Notes

The common, science based procedure to analyse potential impacts of climate change on a system is called Climate Impact Assessment.
This process normally requires a lot of time, resources and expert knowledge concerning climate science and modelling. All three factors are scarce at the farm-level. Still, it is essential to identify core vulnerabilities and prioritize adaptation measures. Consequently, there was the need to adjust and facilitate the climate impact assessment to be useful at the farm-level. The ClimateFarming approach is an explorative approach based on the expert knowledge of the farm members and the ClimateFarming-Consultant.

It is important to acknowledge the limitations of this approach. The results of the climate impact explorations will be influenced by the experiences of the farm members and consequently highly subjective. It is the responsibility of the ClimateFarming-Consultant to guide the exploration in a way that also new or (till now) not experienced climate impacts are considered.

Discussion Questions:

Past Climate Impacts

1. What weather phenomena and extreme climate events have impacted your farm in the past? (e.g. drought periods, heavy precipitation, heat waves)

2. Have you observed any new trends or recent events (e.g. in the last decade)? (e.g. extending spring droughts, more sun hours)

3. What impacts have you observed in the past as a result of these climate events (e.g. loss in yields, increase in disease)?

Application Notes

Past Climate Impacts: The easiest way to conduct and document the climate impact exploration is to use a moderation board where the farm members can first collect and cluster experienced weather phenomena, extreme events as well as recent trends (Question 1 & 2). Following, the farm members can link experienced impacts to the collected weather phenomena, extreme events and recent trends (Question 3).

Example: The farm members add “flooding event 1997” (Question 1) as well as “higher temperatures in spring” (Question 2) to the moderation board. For Question 3, they add experienced impacts. Concerning the “flooding event 1997” these impacts are “damages to the grain storage facility” as well as “heavy erosion”. Concerning the recent trend “higher temperatures in spring”, the farm members add the impacts “earlier sowing” and “partly poor crop development due to limited water availability (higher evapotranspiration)”.

Discussion Questions:

Future Climate Impacts

Temperature: How could it impact your farm when temperatures increase? Is it important whether spring and/or autumn get warmer (important link: late frost days)? Would a mild winter impact my crops?

Hot Days: How could it impact your farm if the number of hot days (>25-30°) and heat waves increase?

Dry periods: How could it impact your farm if dry periods (consecutive days without rain) increase? When are dry periods especially problematic for your farm?

Precipitation: How could a change in precipitation impact your farm? How would a seasonal shift in precipitation affect your farm? Could heavy precipitation events be problematic? Could prolonged wet periods be problematic?

Frost: How could a decrease in frost days (< 0°C) impact your farm? How could a decrease in late frost days impact your farm?

Hail, Wind and Storm: How could a change in hail, wind or storm events impact your farm?

Sun hours: How could an increase in sun hours impact your farm?

Application Notes

Future Climate Impacts: The procedure can be conducted similar to the exploration of past climate impacts. The difference is that you (not the farm members) write down the climate parameters you want to discuss and pin those as headlines on the moderation board. Following, you can use the prepared discussion questions (or your own, farm-specific questions) to provoke the farm members to think and discuss about potential climate impacts on the farm, resulting from a change in the mentioned climate parameters. Depending on the knowledge level of the farm members, you will be in charge to give thought-provoking impulses concerning possible impacts.

Tip: If it is a mixed-farm with different production branches, it might be reasonable to discuss the possible future climate impacts branch by branch.

FUTURE CLIMATE IMPACTS

Temperature
incl. heat waves and frost

Precipitation
incl. dry periods and heavy precipitation events

Other
incl. hail, wind, sun hours etc.

Application Notes

This template only provides one possible option how the results of the climate impact exploration analysis can be processed and summarized for further use. For a farm specialized in crop production, it probably would be sensible to note the potential climate impacts for the main crops. Or for a dairy farm, it might be reasonable to categorize the potential climate impacts in the categories grassland management, animal welfare and production inputs (e.g. water, energy, external forage). Obviously, the right form is highly dependent on the individual farm and should be developed accordingly.

Discussion Questions:

External impacts

Energy/ external inputs: How could your farm be impacted by high energy prices? Which external inputs are you dependent on and how would low availability/ high prices impact your farm?

Workforce: How could your farm be impacted if there is a lack of available workforce? Or if weather conditions are so poor that productivity is seriously impaired?

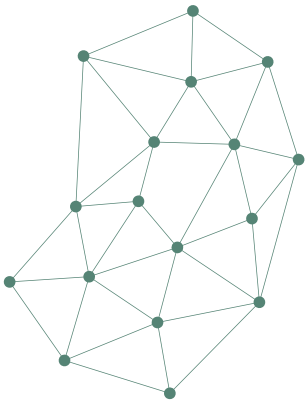
Contractors: How could your farm be impacted if external contractors would not be able to perform their services for you?

Market: How could your farm be impacted if the products you offer are not in demand? Or if your marketing strategy does not work anymore?

Pests and diseases: How could your crops or animals be impacted by upcoming or new pests and diseases?

Other questions: Feel free to develop your own, farm-specific questions to explore how the farm is probably affected by indirect climate impacts

Interactions



Imagine a scenario in which different climate impacts interact with each other or with external impacts. New or unexpexted challenges might arise when several factors change and aggravate problems. Check the chapter **Farming in a changing climate** in the Training Hanbook for more information.
How would your farm be impacted by such scenarios?

Examples

Fuel prices have gone up considerably and at the same time the summer was very dry so your crop will probably not yield as much as anticipated. In terms of revenue, it is not worthwile to even harvest it.

Due to a heatwave, farm workers can only work outside in early morning or late evening hours and tasks start to pile up.

Due to ideal growing conditions for cherries, your harvest was better than expected. Your usual large-scale processor will only take 3/4 of it and you don't have facilities or workforce to process them yourself.

A heavy storm has destroyed the road leading up to your farm. Your customers are not able to get to the pick up station of their weekly vegetable box.

BONUS

TEMPLATE: STEP 2 - CLIMATE IMPACT EXPLORATION II

EXTERNAL IMPACTS

External impacts
incl. fuel prices, pests, workforce

Interactions

Application Notes

Agriculture, the surrounding environment and the socio-economic world are interrelated, impact each other and develop interdependent and simultaneously. Consequently, your farm is indirectly affected by climate impacts on other systems. Farmers need to adapt to the full range of potential impacts, including biophysical, social, cultural, political and economic changes. These indirect impacts are numerous and it is neither possible nor expedient to anticipate all possible impacts. But it is worthwhile to be aware of these possible imapcts, too.

Climate Impact Exploration and Further Information

- The climate impact exploration is a facilitated approach which enables you to include potential climate impacts in the farm vulnerability analysis without the conduction of a full climate impact assessment.
- The exploration is based on the expert knowledge of the farm members (and yourself as the consultant). If you use this approach, it is crucial to communicate its limitations (see Consultation Material: Step 2).

- **https://genial-klima.de/module/klimawandel-checks/**
  - Good starting points concerning changes in climate parameters and vulnerability
- **https://awa.agriadapt.eu/de/:** Quiz for farms which provide a first orientation concerning farm vulnerability; large collection of adaptation measures

- **https://canari-europe.com/**: Comprehensive tool for regionally specific climate projection, including crop specific projections
- **https://www.adapter-projekt.de/klima-produkte/klimakalender.html**: Crop specific climate calender
- **https://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.de**: Country Climate Fact Sheets
- **http://climexp.knmi.nl/start.cgi**: Climate Explorer
- **https://climate.copernicus.eu/**: European climate information
- **https://climate-adapt.eea.europa.eu/en/knowledge/c-a-indicators/c-a-indicators**: Climate indicators
- **https://www.nccs.admin.ch/nccs/de/home/klimawandel-und-auswirkungen/schweizer-klimaszenarien.html**

In order to gain or verify information concenring climate impacts for the specific farm, it might be relevant to consult **production branch specific experts.**

Example: In order to analyse what implications increasing heat waves or higher average temperatures will have on the crop production branch of a farm (or a specific crop), the consultation of a crop production expert could be beneficial.

Application Notes

Independent of how potential climate impacts are integrated in the farm vulnerability analysis, it is important to keep in mind that climate change will impact the individual farm not only by a change in climate parameters. Climate change will also cause indirect effects, like changes in markets, policies, input availability, health or value chains. These indirect effects are nearly impossible to project or even predict, but it is helpful to keep in mind that farmers will face various “unknown unknowns”.

To-Do List

Prioritizing Adaptation Needs

- [ ] If the exploration of climate impacts revealed new SWOT aspects, add those to the list
- [ ] Check the SWOT-Analysis: are there any Weaknesses or Threats which are aggrevated by the discussed climate impacts? If yes, add those to the Template: Adaptation Needs
- [ ] Check the SWOT-Analysis: are there any Strengths or Opportunities which are positively influenced by the discussed climate impacts? If yes, add those to the Template: Adaptation Needs
- [ ] If there are still open spaces in the Template: Adaptation Needs, discuss which other SWOT aspects or climate impacts are the most urgent for the farm (try to find at least five adaptation needs)
- [ ] Document the process and results; clarify open questions; continue with Step 3

Application Notes

Bringing together SWOT-Analysis and Climate Impact Exploration:
It is crucial to link the results and insights of the climate impact exploration with the results of the SWOT-Analysis. As climate change can amplify existing SWOT aspects of the farm, this combination of information provides guidance on which weaknesses and threats (or strengths and opportunities) a farm should prioritize and which alterations of the farming activities might be necessary, especially in the short-term.

TEMPLATE: STEP 2 - DOCUMENTATION

DATE: _____

WHO: _____

What did we do? How did we do it? Important discussion points etc.

Open questions, next steps and tasks

STEP 3 - ADAPTATION MEASURES

Guiding questions: Which adaptation measures potentially fit our farm, our farm objectives and correspond with our farm's vulnerabilities? Which adaptation measures address field-specific problems or opportunities?
Goals: Development of a comprehensive collection of various adaptation measures; adaptation measures should cover different time-scales (short-, mid- and long-term measures)

Preparation	Material and Literature
• All farm members agree with the results of Step 2 • All farm members have the Info-Sheet 6: Ressources for Adaptation Measures • There was enough time to search farm-specific adaptation measures (based on Step 1 and Step 2) • The ClimateFarming-Consultant prepared potential adaptation measures	• Results of Step 1 and Step 2 • Info-Sheet 6: Ressources for Adaptation Measures • Step 3: Measure Assessment I & II (Guiding Questions) • Template: Measure Assessment • Info-Sheet 4: Measure Assessment • Info-Sheet 5: Maladaptation I & II • Consultation Material: Step 3

Summary: In Step 3, potential adaptation measures for the specific farm are collected and assessed. The collection is based on the farm characteristics from Step 1, the stated objectives and the analysed vulnerabilities and chances from Step 2. A selection of resources for adaptation measures is provided in the **Info-Sheet 6: Resources for Adaptation Measures**

After collection, the adaptation measures are assessed according to several factors. These factors should include economic potential, mitigative potential and analysis of potential side-effects (ecological and social).

Application Notes

The collection process should be as inclusive as possible, consulting all farm members (managers, family members, employees etc.). The diverse perspectives on existing or potential issues help to diversify the compilation of diverse adaptation measures. The more diverse the adaptation measures, the better the farm will be able to react facing rapid changes and unforeseen events. The ClimateFarming-Consultant is responsible to keep an overview of the collected measures and - if necessary - bring adaptation measures into the discussion which address more unlikely, but probable climate risks (e.g. erosion/flood protection in a drought prone area) in order to further diversify the collection of adaptation measures.

STEP 3 - ADAPTATION MEASURES

To-Do List

- [ ] The ClimateFarming-Consultant explains the step, its goals and methods
- [ ] Farm members present their measures - these are collected without discussion (for now). The ClimateFarming-Consultant adds and explains additional measures from their preparations
- [ ] The collected measures will be discussed. **The Info-Sheet 4 "Measure Assessment" and "Maladaptation (I + II)"** can provide a basis and guideline for this discussion. The ClimateFarming-Consultant notes important points of the discussion
- [ ] Based on the discussion, it will be decided whether adaptation measures will be further used in Step 4 or will be delayed as reserve measures
- [ ] The farm members decide how they want to organize their adaptation measure collection (e.g. production branch specific, climate risk specific etc.)
- [ ] The ClimateFarming-Consultant collects adaptation measures and discussion/assessment results
- [ ] Document the process and results; clarify open questions; continue with Step 4

Application Notes

For measure assessment, it is important to recognize the temporal dimension of adaptation planning. Potential adaptation measures which seem not feasible in the short-term might be feasible in the future when certain conditions change or climate impacts get more severe. This is important for a comprehensive collection of adaptation measures as well as to improve the mental flexibility of the farm members and better connect short-term measures and long-term options.

Example: The implementation of an agroforestry system is possibly not feasible at the moment due to a lack in workforce. This could change in the future when (possibly) partners can be included in the farm business who want to develop this production branch.

INFO-SHEET 4: MEASURE ASSESSMENT I

Measure Assessment | Guiding questions*

Superordinate question: Does the measure support the farm in achieving farm objectives in the face of climate change?

*Questions which are assessed and discussed can be ticked

Climate Adaptation	
Does the measure address our farm's vulnerabilities (Step 2)?	☐
Does the measure increase our farms' vulnerability concerning certain climate impacts?	☐
Do we (the farm members) feel able to implement the measure?	☐
Which uncertainties or risks exist concerning the measure?	☐

Profitability	
Is the measure economically viable for our farm?	☐
If not: Which conditions could change this?	☐
If not: is the implementation reasonable despite a lack of (short-term) economic viability?	☐

Ecological, Social and other Effects	
Will the measure be beneficial for climate protection?	☐
Will the measure entail positive ecological, social or other effects?	☐
Will the measure entail negative ecological, social or other effects?	☐
If negative side-effects can't be avoided: Should the measure be implemented despite the negative side-effects?	☐

Measure Assessment | Guiding questions*

Superordinate question: Does the measure support the farm in achieving farm objectives in the face of climate change?

*Questions which are assessed and discussed can be ticked

Maladaptation-Check*	
No-Regret: Will the measure be beneficial, independent of how climate change will develop?	☐
GHG-Emissions: Are there direct negative impacts on climate protection? Are there indirect negative effects on climate protection (e.g. leakage effects)?	☐
Flexibility/Reversibility: Can the measure be modified quickly in order to react to changing conditions? Can the measure be complemented or replaced easily by another measure?	☐
Testing: Is it possible to test the measure (small-scale or low-cost approach)?	☐
Diversification: Is the measure improving the diversification of the farm?	☐
Negative external effects: Will the measure impose negative impacts on other persons, actors or natural systems?	☐
Path-Dependencies: Will the measure entail certain dependencies which could create new risks or hamper future adaptation?	☐

(1) Maladaptation and the categories are further discussed in the **Info-Sheet 5: Maladaptation**

Application Notes

The displayed guiding questions represent only one option how adaptation measures can be evaluated prior to implementation - based on stakeholder discussion. A more comprehensive assessment, based on literature review and external consultation is also possible, but requires more ressources. Independent of the methods used to assess effectiveness and viability of adaptation measures, it is important to also discuss adaptation relevant criteria like uncertainties and maladaptation potential.

TEMPLATE: STEP 3 - MEASURE ASSESSMENT

This template can be used to record the discussion results of the adaptation measure assessment.

ADAPTATION MEASURE: _____

Climate Adaptation

Profitability

Ecological, Social and other Effects

Maladaptation potential

TEMPLATE: STEP 3 - DOCUMENTATION

DATE: _____

WHO: _____

What did we do?
How did we do it?
Important discussion points etc.

Open questions, next steps and tasks

INFO-SHEET 5: MALADAPTATION I

Maladaptation (1)

Several definitions for maladaptation exist, which mostly refer to the “unintended negative consequences of adaptation policies and measures” (P. 79, Neset et al., 2019).

Maladaptation can occur when you ignore complexity and uncertainty in adaptation planning. Insufficiently planned adaptation can lead to **path dependencies** or **lock-in effetcs**. Broadly speaking, this means that adaptation measures (or other decisions) which are probably beneficial in the short term can reduce the adaptation options in the future and so reduce the overall capability of a farm to adapt to new and unforseen developments.

The challenge for adaptation planning is to reduce the risk of maladaptation already in the planning process, before actual measures are implemented.

Example:

The construction of a dairy shed with a sophisticated, but expensive air conditioning system can constitute a reasonable adaptation measure to aggravating heat and heat waves. However, if the measure is not well planned and probably also drought becomes a problem, the reduced forage yields could obstruct the viability of the dairy cow business.
In an extreme scenario, the farmer maybe has to stop dairy production.
If this happens before the air-contioned shed is payed off, the farmer is heavely limited in their financial flexibility and will potentially not be able to implement other adaptation measures or switch to other production branches.

(1) Maladaptation is further discussed in the ClimateFarming Trainer Handbook

INFO-SHEET 5: MALADAPTATION II

Maladaptation Criteria

No-Regret: A No-Regret measure will be beneficial for the farm, independent of the development of climate change. A good example is the accumulation of organic carbon in the soil: it entails many positive effects for farm-level adaptation, but likewise it can improve yields and provides beneficial effects for the farm and the environment

GHG-Emissions: Adaptation measures should in the best case provide beneficial effects also for climate protection. At least, it should not increase farm-level emissions and consequently accelerate climate change. Likewise, the measure shouldn't lead to leakage-effects, increasing GHG-emissions somewhere else. **See "Negative external effects"**

Flexibility: Measures which can easily be modified or replaced without producing high costs are generally less prone to be maladaptive. For example, the cultivation of a new crop is a flexible measure and can be undone easily. The costly renovation of a dairy shed with an air-conditioning system is not flexible and only reversible in the mid- to long-term

Testing: If a measure can be tested without high (financial) risks and is reversible without significant costs or effort, it is less prone to be maladaptive

Diversification: An increase in the diversity of a farming system is generally associated with an increase of resilience. This refers mainly to the diversification of income streams, but can also refer to diversification in the crop rotation, in the landscape or other aspects of the specific farming system

Negative external effects: If adaptation measures implemented at our farm have negative impacts on other persons, actors or natural systems, these are considered as negative external effects. This should be avoided

Dependencies: Dependencies are not per se negative. In the case of cooperations, they can actually be positive for adaptation. However, dependencies increase the uncertainties about how climate impacts will affect the farm and should be analysed with care

ClimateFarming Measure Catalog

https://humus-klima-netz.de/massnahmen-im-ueberblick/

https://genial-klima.de/

https://www.boden-staendig.eu/massnahmen

https://solmacc.eu/climate-friendly-practices/

https://awa.agriadapt.eu/de

https://www.klimahumus.de/#startpunkt

https://www.conservationevidence.com/data/index

https://humusbewegung.at/zwischenfruche/

https://www.klimabauern.ch/ideenkatalog

https://www.thelexicon.org/regen-ag/ten-principles/

https://www.eufarmbook.eu/de/

https://www.bodenistleben.at/mitgliederbereich/

...

STEP 4 - FARM CLIMATE STRATEGY

Guiding questions: How can adaptation measures be combined into a strategy for our farm? Where are synergies and trade-offs? Does the farm climate strategy enable a resilient farm development?

Goals: Development and assessment of a farm climate strategy, with short-, medium- and long-term measures (timeline); optional: formulation of contingency-measures

Preparation	Material and Literature
• The ClimateFarming-Consultant processes the results of Step 3; • Farm members are provided with the results from Step 3	• Results from Step 3 (Adaptation Measures) • Material for the development of the farm climate strategy (e.g. whiteboard, A3-paper); alternatively digital tools (e.g. slides) • Step 4: Strategy Assessment I - IIII • Optional: SWOT-Analysis & Contingency Measures • Consultation Material: Step 4

Summary: The first action is to create a timeline. In this timeline, the different adaptation measures can be combined over the course of the time. The goal is to maximize synergies, reduce trade-offs and to plan short-term measures in accordance with long-term options. The farm climate strategy should provide farmers and advisors with a roadmap that specifies which adaptation measures can be tested or directly implemented (short-term; 0-5 years), which measures should be planned and prepared for (medium-term; 5-20 years), and which perspectives exist for climate-adapted farm development (long-term; >20 years). Overall, the farm climate strategy should enable the farm to take advantage of synergies between adaptation measures and to deal with diverse and potentially aggravating climate impacts. Analogous, the measures can be used to develop field-specific action plans.

STEP 4 - FARM CLIMATE STRATEGY

To-Do List

- [ ] The ClimateFarming-Consultant explains the step, its goals and methods
- [ ] Farm members and ClimateFarming-Consultant agree how the farm climate strategy should be developed (e.g. with a whiteboard, A3 Paper, digital etc.)
- [ ] Every farm member as well as the ClimateFarming-Consultant develop a farm climate strategy individually, combining the adaptation measures from Step 3 and potentially adding additional measures
- [ ] Everyone presents their farm climate strategy. The ClimateFarming-Consultant takes notes, looking for similarities and differences
- [ ] The farm members dicuss and modify the different strategy proposals and try to develop one strategy on which all agree; the ClimateFarming-Consultant moderates the process and provides impulses
- [ ] As soon as a farm climate strategy is composed, the multi-criteria assessment will be conducted; the decision trees provided in Step 4 can serve as a basis for this analysis
    - Should the analysis reveal considerable deficiencies in any of the categories (0 points), the farm climate strategy should be modified

BONUS

- [ ] Optional: A second SWOT-Analysis is conducted in order to reveal weak points and potentially overlooked opportunities of the farm climate strategy. Using the results of the SWOT-Analysis, the farm members formulate contingency-measures in order to hedge the success of the farm climate strategy. More information can be found in **Info-Sheet 7: Robust Strategies**

Application Notes:

Farm climate strategies can be illustrated in various ways. One option is by hand with paper (in the best case A3 or bigger) or whiteboard. Paper is easy to apply, but changes are hard to make. Alternatively, the ClimateFarming-Project provides a Slides Template which enables the users to develop and save different farm climate strategies. The digital approach is especially adviseable for farms with several production branches. However, the used option can and should always be adjusted to the specific farm context.

STEP 4: STRATEGY ASSESSMENT I

Assessment Farm Climate Strategy | Decision-Tree

Resilience-Proxies*

1. Recovery:
Is the strategy able to improve the ability of the farm to recover from climate impacts quickly**?

YES

NO

2. Redundancy:
The strategy entails various adaptation measures which respond differently to climate impacts?

YES

NO

3. Flexibility:
The strategy enables the farm to react quickly in the face of surprising climate impacts, e.g. the occourrence of a new pest or disease?

YES

NO

4. Adaptiveness:
The strategy enables the farm to adjust its goals and methods in the mid- to long-term?

YES

NO

5. Comprehensiveness
In the development of the strategy, various perspectives and potential climate impacts were included and addressed?

YES

NO

Does the strategy fulfill most of the categories with minor trade-offs or deficits? — 3 Points

Does the strategy fulfill most of the categories with some trade-offs or deficits? — 2 Points

Does the strategy fulfill most of the categories, but with major trade-offs or deficits? — 1 Point

Does the strategy only fulfill some of the categories or feature fundamental trade-offs or deficits? — 0 Points

Application Notes

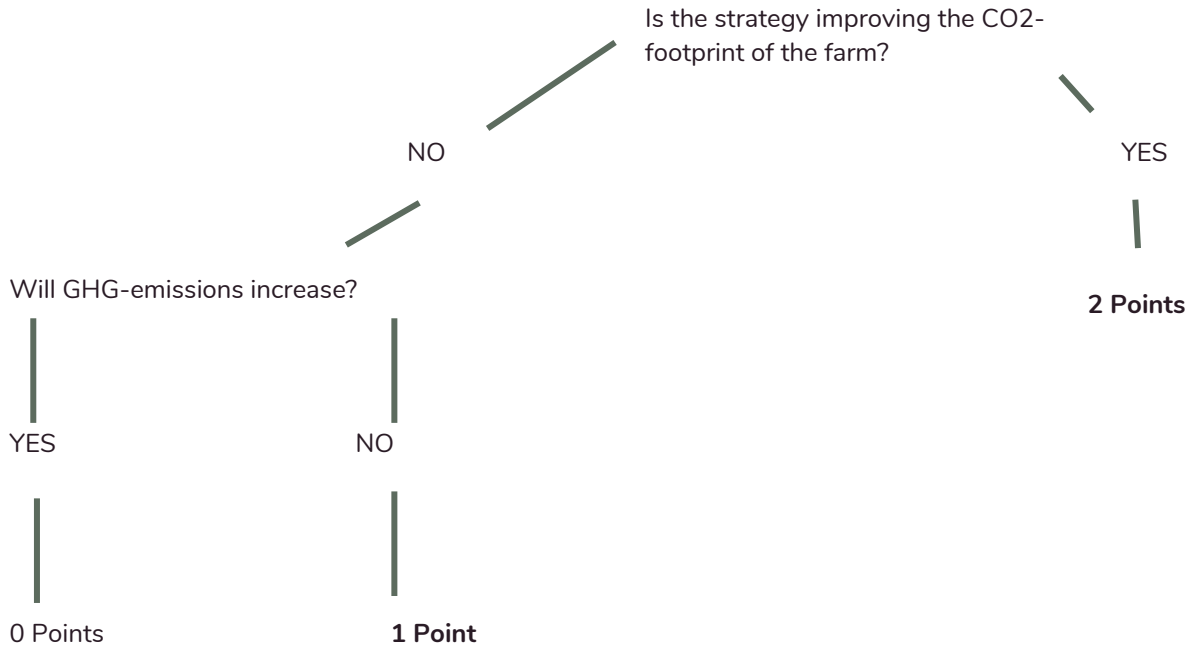
Important is to acknowledge that the different resilience proxies overlap and influence each other. As it is not possible to use a measurable metric for resilience, these qualitative proxies can help you to examine adaptation decision and strategies.

* Resilience-Proxies are further explained in the Consultation Material: Step 4

** Example: An extreme event could be a multiannual drought

Assessment Farm Climate Strategy | Decision-Tree

Climate Protection*



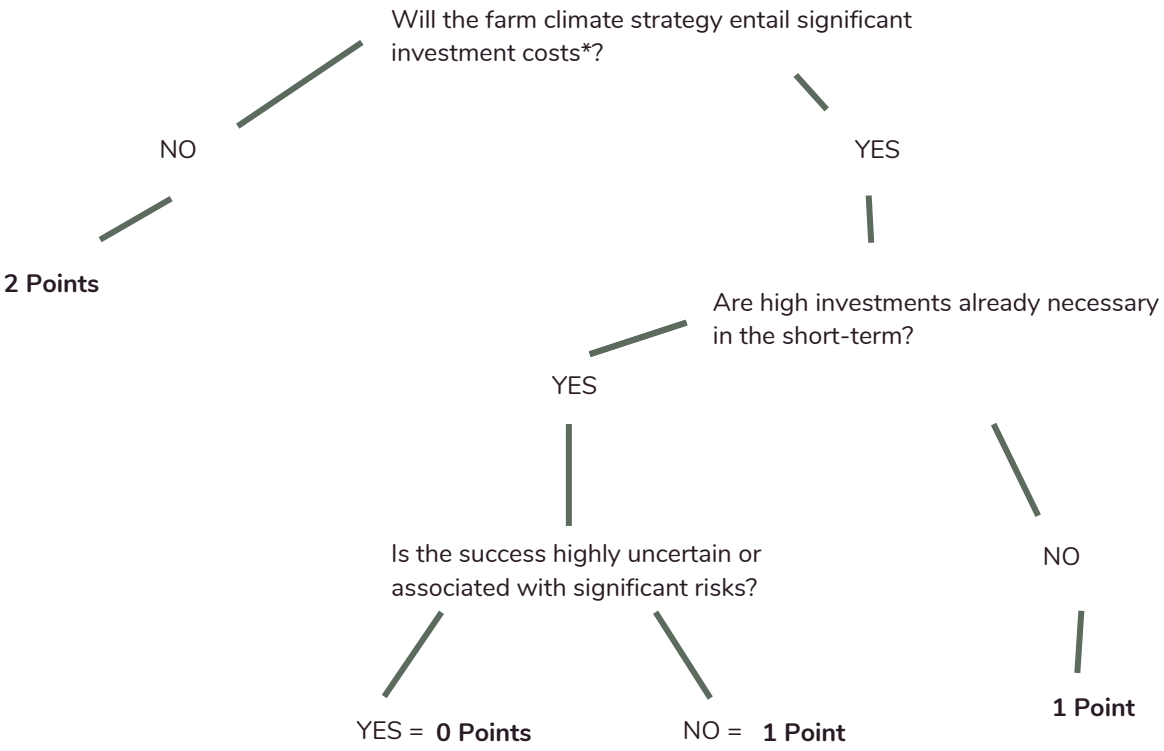
*Climate protection potential compared to the baseline CO2-footprint of the farm, if available

Application Notes

As it is (generally) not possible to analyse all strategy options in a sophisticated and scientifically sound manner, farm members and ClimateFarming-Consultants need to be aware of the level of subjectivity involved in the assessment. Preferences, risk tolerance and personal experience will make certain measure combinations appear more viable or appealing than others - even if other measures and strategies might be more suitable. This can not be prevented completely. Consequently, it is even more important that consultants and farm members are aware of the limited capability of objective reasoning. In some cases, external expert service is adviseable, e.g. a profitability calculation for a potential biogas plant or an external climate balancing to receive more precise information on the climate protection potential of a farm climate strategy.

Assessment Farm Climate Strategy | Decision-Tree

Investment Costs*



*Investment costs are defined as significant if they exceed regular operational investment costs in the considered time period (e.g. over a 15-year period)

Application Notes

Important is to acknowledge that costs can have different sources. Not only are investment costs relevant, but also rising labour costs or expenditures for the acquisition of knowledge. Another crucial aspect are **transfer costs**. Transfer costs arise when you need to change from one adaptation measure to another which do not complement each other.

Example

A farmer with a boarding horse husbandry income branch decides to invest in a very specialized infrastructure, a barn hay dryer. This investment is only paying off if there is enough forage to dry. This could be obstructed if grassland yields fall drastically, e.g. due to persistent drought events. If the boarding horse husbandry becomes unprofitable, the transfer costs to switch to another income branch rose higher due to the investment in the barn hay dyer.

Transfer costs are hard to quantify, but should be considered in decision-making.

TEMPLATE:
STEP 4- STRATEGY ASSESSMENT

Assessment Farm Climate Strategy | Decision-Tree

Ecological, Social and other Effects*

Positive	Negative

*Here, you can list potential positive and negative side-effects. If necessary, produce an extra document to note all identified side-effects

Application Notes

The multi-criteria assessment of a farm climate strategy is mostly based on the insights from Step 3 concerning the individual adaptation measures. However, it is central to not only see the sum of the individual measures constituting a farm climate strategy, but the synergies and trade-offs resulting from the combination of the different measures.

TEMPLATE: STEP 4 - STRATEGY ASSESSMENT SUMMARY

Resilience proxies

Score:

Discussion Notes:

Climate protection

Score:

Discussion Notes:

Investment costs

Score:

Discussion Notes:

Ecological, Social and other Effects

Discussion Notes:

TEMPLATE: STEP 4 - SWOT ANALYSIS & CONTINGENCY MEASURES

SWOT	Contingency-Measures
S Strengths	
W Weaknesses	
O Opportunities	
T Threats	

TEMPLATE: STEP 4 - DOCUMENTATION

DATE: _____

WHO: _____

What did we do?
How did we do it?
Important discussion points etc.

Open questions, next steps and tasks

BONUS

INFO-SHEET 7: ROBUST STRATEGIES

Contingency Measures

More Information: Consulting Material: Step 4

Contingency-measures are supposed to increase the robustness of the farm climate strategy via different mechanisms. These measures are not necessarily additional adaptation measures.

- **Defensive action (DA)**: actions taken to preserve the original strategy or meet (not climate change related) challenges which could obstruct the farm climate strategy
- Corrective action (CA): actions which alter the farm climate strategy in order to react to new knowledge, changed conditions or trigger events
- **Opportunity action (OA)**: actions which take advantage of opportunities arising in order to further improve performance and/or resilience of the farm climate strategy

Example (DA): One part of the farm climate strategy is to install an agrophotovoltaic system. The farm members identified the disapproval of the installation by the local citizens as a potential threat. A contingency measure could be to initiate a town-hall meeting in order to convince the people of the benefits.

What-if Scenarios

What-if scenarios are supposed to motivate the farm members (and the ClimateFarming-Consultant) to not only think in plausible scenarios (which seem realistic from a present perspective), but in scenarios which might have a low probability, but are still possible. These scenarios are also called **High-Impact, Low-Probability Events**. This is important, as it confronts the farm members with more severe trajectories of climate change impacts. Like all other methods, also this one is supposed to improve the consideration of climate change uncertainty into the adaptation planning process and consequently improve the resilience of the farms adaptation decisions.

Examples:

- What if the farm is confronted with an energy blackout over several days?
- What if temperatures regularly become so high that working outside in harvest times becomes unbearable for humans?
- What if three very dry summers are followed by two very wet summers or vice versa?
- What if time-sensitive transportation of goods (e.g. for processing milk) becomes less predictable due to heat/ storms/ etc.?

STEP 5.1 - MONITORING

Guiding questions: How can you monitor the effectiveness of your farm climate strategy? Which indicators are relevant for your farm and strategy?

Goals: Decide how the achievement of farm objectives is monitored; decide on relevant indicators which should be monitored; clarify responsibilities; set up a regular review event to examine and discuss objective achievement, the farm climate strategy and adaptation measures

Preparation	Material and Literature
• All farm members agree with the developed farm climate strategy and its assessment	• Results: Farm Climate Strategy and Assessment • Template: Monitoring-Indicators • Template: Regular Review Event • Cheat-Sheet: Indicators for Monitoring • Consulting Material - Step 5

Summary: Monitoring, evaluation and learning are central elements in farm management and adaptation processes. Only through regular monitoring you can assess the success or failure of adaptation measures - not only in monetary terms, but also concerning environmental or social objectives. Step 5.1 aims at developing a farm-specific monitoring. This should enable farmers to recognise relevant changes at an early stage and to act proactively. The montoring entails several aspects:

- Specification of farm-specific indicators - “Which climatic and non-climatic developments affect our farm and our climate strategy?”
- Monitor these indicators and control the success of the farm climate strategy - “Are we achieving our farm objectives?”
- Based on this information, the monitoring signals the necessity of modifying the farm climate strategy or individual adaptation measures - in the face of fundamental changes (e.g. unforseen retirement of a core employee), this could entail complete reassessment of the strategy

Furthermore, Step 5.1 entails the development of a **regular review event**. This is a event which aims at controlling adaptation measures, the farm climate strategy and objective achievement in fixed time intervals, additionally to the ongoing monitoring.

STEP 5.1 - MONITORING

To-Do List

- [ ] The ClimateFarming-Consultant explains the step, its goals and methods
- [ ] The farm members explore which indicators are relevant for the farm and the climate strategy that should be monitored; the **Cheat-Sheet: Indicators for Monitoring** can provide a starting point, especially for the measure-specific monitoring
- [ ] The responsibilities for the monitoring are clarified - "How do we want to monitor the indicators?"; "Who monitors what?"
- [ ] The farm members design a regular review event; they decide how and when a regular review event could be integrated in the regular farm management - see **Info-Sheet 8: Regular Review Event**
- [ ] Document the process and results; clarify open questions; continue with Step 5.2 - Implementation

Application Notes

Monitoring of climatic changes is complicated by the differentiation between natural variability and real trend changes. This does not only apply to climatic changes, but also to other factors, e.g. market prices for agricultural products. Also the determination of a critical value that determines the implementation of a new adaptation measure is highly subjective.

Example

A three-year drought leads Farmer A to shift to drought-resistant crops, while Farmer B perceives this as regular variability.
Additionally, monitoring and evaluation suffer under time constraints in the regular farm management. This issue makes the periodic trigger event even more worthwhile.

TEMPLATE: STEP 5.1 - FARM MONITORING INDICATORS

STEP 5.1 - MONITORING

Farm Monitoring Indicators

Application Notes

In the case of a complex farm with different production branches, it is probably reasonable to separate indicators into external and internal indicators or to collect branch specific indicators.

Example

External indicators can exemplarily comprise climatic and environmental changes, technological innovations, market developments and political and cultural changes. Internal indicators could be working hours, yield, income or job satisfaction. This should enable farmers to recognise relevant changes at an early stage and to act proactively.

INFO-SHEET 8:
REGULAR REVIEW EVENT

Regular review events are another approach to effective monitoring. These are regularly scheduled events at which all farm members meet to discuss and check the farm climate strategy and the underlying assumptions* in a systematic manner. This means deciding when the event will take place, who is reporting on what and how the general agenda should look like. Exemplarily, a regular review event could be scheduled once a year, for example in late autumn after sowing.

During the event, basically the same questions and aspects as during regular monitoring are discussed, but collectively. Consequently, the guiding questions for monitoring can also provide guidance for the regular review event.

- **Guiding question(s)**: Do the implemented climate measures meet our farm objectives? What works, what does not work? What can we learn from this? What changes can we observe (indicators)? How do we have to react to them or act preventively?
- **Monitoring of the implemented measures, farm objectives and the defined indicators.**
- **Decision on**
  - Modification of the adaptation measures implemented
  - Implementing contingency measures
  - Introduction of new adaptation measures
  - Modification of the farm climate strategy
  - Necessity to re-plan the farm climate strategy or re-run the ClimateFarming Cycle.
  - Integrate new knowledge and lessons learned into the farm climate strategy and its implementation.

*Underlying assumptions in this context means the cornerstones of the farm climate strategy. Examples could be the availability of land (lease agreements), the sufficient availability of irrigation water, a secure sales market for direct marketing or the expertise of certain farm members.

TEMPLATE: STEP 5.1 - REGULAR REVIEW EVENT

STEP 5.1 - MONITORING

Here you can specify when and how the regular review event will be conducted

When is the event scheduled?

What will be the agenda?

Who will present what?

STEP 5 - DOCUMENTATION

STEP 5.1 - MONITORING

DATE: _____

WHO: _____

What did we do?
How did we do it?
Important discussion points etc.

Open questions, next steps and tasks

STEP 5.2 - IMPLEMENTATION

Guiding questions: Which measures can you implement directly? Which measures can be tested? Which measures do you need to plan and prepare? Who will take care of what?

Goals: Development of an implementation plan/timeline for the near-term implementation; develop measure-specific monitoring; clarify responsibilities

Preparation	Material und Literature
 Engage external (expert) consultants for specific adaptation measures	• Results: Measure Catalog • Results: Farm Climate Strategy and Analysis • Template: Implementation Plan • Template: Adaptation Measure Monitoring • Consultation Material - Step 5

Summary: In Step 5.2, it will be specified how adaptation measures will be practically implemented on the farm. Test- and field-trials are developed and responsibilities clarified. For mid-term measures, the planning starts.

How this Step will be realized is completely dependent on the farm members and the ClimateFarming-Consultant. If the necessary time-resources are available, it might be beneficial to develop an elaborated implementation-plan including experimental design and monitoring of measure success. Likewise, preparation for the mid- to long-term adaptation should be started, as these measures are generally more complex and associated with higher investments. This includes research, identification of key actors and probably the development of a preliminary timeline of tasks.

Simultaneously with the implementation, the monitoring starts. This entails the compilation of baseline values for monitoring indicators of implemented measures as well as the monitoring of farm objective achievement.

STEP 5.2 - IMPLEMENTATION

To-Do List

- [ ] The ClimateFarming-Consultant explains the step, its goals and methods
- [ ] Based on the results of Step 4, the farm members discuss which adaptation measures can be implemented right away (especially no-regret measures) and which can be tested or for which a test-/field-trial can be set up
- [ ] The implementation of the different adaptation measures is roughly scheduled
- [ ] The farm members discuss which measure should be planned and specify first steps
- [ ] The farm members clarify responsibilities for the different adaptation measures and the related tasks (planning, implementation, monitoring)
- [ ] The responsible persons compile baseline values for the different monitoring indicators in order to control measure success
- [ ] Optional: It is checked whether certain contingency-measures could be implemented right away

Application Note

Regarding the implementation, it is crucial to adjust the speed to the specific farm and its means. Should the farm be able to provide the necessary financial- and time-ressources to quickly implement and test several measures, this should be supported. A good option, also for rather cautious farmers, is to visit a farm on which the specific adaptation measure is already in use.
Dependent on the complexity of the adaptation measures, the implementation should be planned together with expert service.

STEP 5.2 - IMPLEMENTATION

PRODUCTION BRANCH OR MEASURE: _____

RESPONSIBLE: _____

TIME HORIZON: _____

Measure(s)

What do we do? When do we do it?

Cost and Time Estimate

TEMPLATE: STEP 5.2 - ADAPTATION MEASURE MONITORING

STEP 5.2 - START OF MONITORING

PRODUCTION BRANCH OR MEASURE: _____

RESPONSIBLE: _____

TIME HORIZON: _____

Goals

Indicators

Indicator Baseline*

DATE OF INITIAL ASSESSMENT:

Indicator Development

An additional document (e.g. a table) might be useful to track the development of an indicators

* The **Indicator Baseline** is the starting point for your measurement or assessment of an indicator. For example, if you introduce cover cropping as an adaptation measure, you might chose aggregate stability as one of your indicators for soil health. You will regularly check aggregate stability on the specific field in order to monitor improvements. The first soil assessment and its results (see Step 1, Farm Survey) are the baseline for this indicator.

STEP 5 - DOCUMENTATION

STEP 5.2 - IMPLEMENTATION

DATE: _____

WHO: _____

What did we do?
How did we do it?
Important discussion points etc.

Open questions, next steps and tasks